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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DATE: January 16, 2007

SUBJECT: Ground Water Discharge to River
Chemical Recovery System Site

FROM: Dr. Luanne Vanderpool, Geologist *Luanne Vanderpool*
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TO: Gwendolyn Massenburg, RPM

This memo responds to the question you posed regarding ground water discharge to the East Branch of the Black River at Chemical Recovery System (CSR) site. My answer to this question is based largely on my review of the CRS Group December 2006 Technical Memorandum on Groundwater Discharge and Douglas McWilliams' 12/11/2006 email which provided information on the elevation of the East Branch of Black River. As part of this review, I have also reviewed portions of the Site's Remedial Investigation Report.

Based on the information I have reviewed I am reasonably confident that the ground water contaminant plume is discharging into the East Branch of Black River. This opinion is based on the elevation of the river provided in the 12/11/06 email from Douglas McWilliams and groundwater levels and flow directions at the site. I am not confident that the CRS Site Group's conclusion that groundwater contaminants are attenuating before they reach the river is correct; this assertion is not supported by any relevant data.

Is the plume discharging into the River?

The 12/11/06 email from Douglas McWilliams specified the elevation of the mean high water mark of the river as 682 feet and cited a site survey as the source of this information. No details of the survey were provided in the email. There was no mention in the Remedial Investigation (RI) Report of surveying the mean high water mark. When was the survey done, what locations were surveyed, and how was the "mean high water mark determined"? This email also "calculated" the elevation of the bottom of the river based on the depth of the River being between 672 and 680 feet as stated in the Ecological Risk Assessment. Again, no details were provided in the RI, nor were any details provided in the Ecological Risk Assessment. How, where, and when were depths measured? These details should be provided since my opinion relies heavily on the elevations stated in the email.

There are monitoring wells screened in two horizons at CRS, shallow wells and deep wells. The shallow wells (MW-1, MW-5, MW-6, and MW-16) are screened in sandstone. Unfortunately the RI lacks basic well construction information; the elevation of wells screens is absent. I estimated elevations of well screens based on the elevations shown in RI cross sections (Figures 3-2, 3-3, 3-4, and 3-5). MW-5 and MW6 are water table wells screened at elevations substantially higher than the highest river bottom elevation. While the RI provided no screen length or depth for

shallow wells MW-1 and MW-16, the total depth of these two wells is comparable to or shallower than the river bottom elevation. Ground Water levels measured in November and December 2003 show that flow is toward the river.

The deep wells (MW -7D, MW-8D, and MW-9D) are screened in a low water yielding shale unit at depths which are substantially below the elevation of the river bottom. The wells behave as confined wells since the measured groundwater levels are substantially higher than the screen depths (based on elevations estimated from RI Figures 3-2, 3-3, 3-4, and 3-5).

There are no nested wells and thus vertical gradients between the shallow and deep wells can not be directly calculated. However, vertical gradients may be estimated by comparing the flow map for the shallow wells to the flow map for the deep wells (as was done in the December 2006 CRS Site Group Technical memorandum). In the vicinity that data exists (within a triangle defined by the three deep wells MW -7D, MW-8D, and MW-9D) , this analysis indicates flow from the deep wells on November 12, 2003 is upward or horizontal towards the river. Within the triangle formed by the three deep wells, in November and December 2003 the horizontal direction of ground water flow is toward the river. Where flow is horizontal, ground water within the shale may flow beneath the East Branch of the Black River.

Most of the contamination at CRS has been found in the shallow monitoring wells (and the more shallow Geoprobe installed temporary wells GP-6, GP-14, and GP-16) installed in the fill above the sandstone. The contamination plume appears to be in the sandstone and fill. While the deep shale wells are screened below the base of the river, and flow may be horizontal within portions of the shale toward and under the river, these wells yield little water and there was little contamination detected in the deep wells. Consequently it is unlikely that contaminated ground water is underflowing the river and a remedy decision based on the assumption that the plume discharges into the river is reasonable. But additional wells are needed to confirm this assumption.

While it is most probable that the ground water contamination is discharging into the river, there is one possibility that was not discussed in the Remedial Investigation. At MW-6, levels of 1,1,1-TCA and TCE are quite high, approximately 2% of solubility. These levels are high enough to suggest the possibility of DNAPL somewhere nearby. If there is DNAPL, the free product could have moved vertically downward without regard to ground water flow direction and generate a plume which does not discharge into the river.

Are contaminants attenuating before reaching the River?

The CRS Group December 2006 Technical Memorandum on Groundwater asserts that groundwater contaminants are attenuating before they reach the river; this assertion is not supported by data. Shallow well MW-6 is highly contaminated. While there is evidence that conditions at MW-6 are favorable for biodegradation, there are no wells directly downgradient of MW-6 located along a flow path that passes through the MW-6 well screen that document attenuation. Deep well MW-8D is located in a laterally downgradient direction, but it is screened approximately 30 feet deeper (see Figure 3-4 of the RI Report). MW-7D, is also screened 30 feet deeper as well as being located slightly side gradient of the flow path of MW-6. GP-14 and GP-16 are side gradient of the flow path of MW-6 and screened above MW-6. These are the only ground water monitoring points available between MW-6 and the river. Thus there are no

monitoring wells located downgradient of MW-6 and screened at the same depth. There is no way to know how much attenuation is occurring as groundwater flows from the eastern portion of the site to the western edge. Additional wells are needed to determine if (and how much) attenuation is occurring across the site.

It appears that no attempt was made to vertically profile ground water within the sandstone. Thus it is unknown whether the levels of contamination detected at MW-6 are the highest levels that might be present. While the northern extent of the plume may have been delineated based on the low levels of contaminants detected in MW-5; this location also was not vertically profiled. As a result there remains some uncertainty regarding the northern extent of the plume.

Recommendations

Assuming the remedy decision goes forward as proposed, as a part of remedy design I recommend additional monitoring wells located downgradient (along the same flow path) of MW-6, as well as lateral to the plume. Depth should be determined based on vertical profiling to ensure that MW-6 represents the core of the plume and that new wells are screened at appropriated depths. Wells are needed near the river to show that contamination is not underflowing the river. Also needed are wells located on the western side of the river to confirm that there is not contamination underflowing the river, particularly if significant contamination is found in groundwater on the eastern side of the river.

I hope these comments are of assistance to you. If you have questions or require further help, please call me at 3-9296.

cc. S. Padovani, Section Chief, AADS Section